GRASSHOPPER CONTROL

with

ALDRIN, CHLORDANE, *and* TOXAPHENE

BUREAU
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This publication was prepared by Claude Wakeland, Division of Grasshopper Control, and J. R. Parker, Division of Cereal and Forage Insect Investigations. It supersedes EC-11, Chlordane and Toxaphene for Grasshopper Control, issued by the Bureau of Entomology and Plant Quarantine in February 1950.

THE VALUE of chlordane and toxaphene in grasshopper control has been demonstrated by their extensive use in many States. Aldrin was used successfully in large-scale tests in 1950 and is now also recommended for general use. On range vegetation and dense succulent crops these insecticides are particularly effective when applied as sprays. Under such conditions they give better initial results and continue to kill longer than sodium fluosilicate bait, which for many years was considered the best weapon for fighting grasshoppers. They may also be applied as dusts, but sprays give higher initial kills and continue to kill over a longer period.

Baits still have a place in grasshopper control. In dry vegetation which is no longer attractive to grasshoppers as food, and in fall-seeded grain when the plants are only a few inches tall, baits are more effective than sprays or dusts. Baits containing aldrin, chlordane, or toxaphene give quicker and longer killing action than sodium fluosilicate baits. Since these insecticides are soluble in common organic solvents, it is possible to spray them onto dry bran, and thus reduce mixing costs and provide a bait suitable for spreading by aircraft.

Sprays and Dusts

Formulations and Dosages.--Ready-mixed solutions, emulsifiable concentrates, wettable powders, and dusts containing aldrin, chlordane, or toxaphene in various strengths are available from local dealers. Emulsifiable concentrates and wettable powders should be diluted with water to suit available spraying equipment. Solutions may be diluted with common solvents such as kerosene and diesel fuel. Aldrin is usually more effective in oil solutions than in emulsions, although both types of sprays have proved highly satisfactory. With emulsions there is less danger of burning foliage.

Whatever the formulation or dilution, the quantity of technical material applied per acre should conform to the following recommendations:

	Sprays	Dusts
Aldrin	2 oz.	3 oz.
Chlordane	1/2 - 1 lb.	3/4 - 1 1/2 lb.
Toxaphene	1 - 1 1/2 lb.	1 1/2 - 2 1/2 lb.

Use the lower dosages of chlordane or toxaphene for young grasshoppers in short, dense, succulent vegetation and on open stands of taller growth when long-continued killing action is not essential.

Use the higher dosages when vegetation is tall and dense or when long-continued killing action is desired. When it is necessary to control young

grasshoppers before the main hatch is completed, the higher dosages may extend residual action long enough to kill the rest of the hatch and thus save the cost of a second treatment.

Dosages even higher than those listed may be needed for the treatment of barrier strips or for late-season use when grasshoppers are adult and vegetation is maturing. When vegetation becomes so dry that grasshoppers feed on it only sparingly, failure may be expected regardless of the dosages used.

The dosages recommended are based on performance in experimental trials and in general use. They were endorsed by the State Leaders' Advisory Committee at its meeting at Denver, Colo., December 14-15, 1950. These recommendations should not be expected to cover all local conditions within the many States where grasshopper control is needed. They are offered as a guide to help individuals solve their own problems. If difficulties are encountered, county agricultural agents, extension entomologists, and State entomologists should be consulted.

Dieldrin, Dilan, heptachlor, lindane, methoxychlor, and parathion have shown promise in grasshopper control. They have not been tested so widely as aldrin, chlordane, and toxaphene, and should not be used unless specifically recommended by State entomologists.

Time and Methods of Application.--Aldrin, chlordane, and toxaphene are most effective when applied evenly at the right time and in the right places. They may be applied with ground sprayers or dusters, or by airplane. The equipment used should be carefully adjusted so that the rate of application is accurately controlled. Too much material is wasteful and increases the danger of harmful residues. Too little insecticide also wastes time and materials, because it will not prevent crop losses. Areas treated with less than effective dosages will have to be retreated to obtain control.

Farmers using these insecticides as sprays or dusts for grasshopper control should proceed as follows:

1. Determine the location of dangerous infestations of young grasshoppers in relation to the fields planted to crops. They may be found on roadsides, canal banks, field margins, or idle lands bordering cultivated fields, as well as in the fields themselves. Spray or dust these places when the main hatch is completed or when the young grasshoppers begin to move off the hatching grounds, and thus greatly reduce the acreage that otherwise might have to be treated later. Grasshoppers that damage row crops generally hatch in the field margins. Timely spraying or dusting of vegetation in such margins will destroy grasshoppers before they move into the fields.

2. Prevent grasshoppers from damaging corn by treating margins of cornfields and adjacent infested small-grain fields or weed patches when the small grains begin to mature and before the grasshoppers move into the corn.

3. When an entire alfalfa field is infested with damaging populations of grasshoppers, it is ordinarily most economical to cut the alfalfa and then apply aldrin, chlordane, or toxaphene to protect the next cutting. Spray or dust field margins, ditch banks, patches of weeds, or uncut strips of alfalfa where grasshoppers have concentrated. Grasshoppers frequently hatch in considerable numbers after the first crop has been harvested. To control these insects, spray or dust the next crop as soon as the new growth is about 6 inches high. This practice protects the new growth and avoids heavy residues at harvesttime.

4. Range grasshoppers can be controlled more completely and economically with aldrin sprays than with baits. Use 2 ounces of aldrin in 1 gallon of solvent per acre. Begin control measures when hatching of dominant species is completed, and finish before egg laying by such species begins.

Precautions. --Aldrin, chlordane, and toxaphene are poisonous to man and animals, but with care they can be

handled safely at strengths recommended for grasshopper control. In concentrated form they may cause acute poisoning when in contact with the skin or if inhaled or swallowed accidentally.

KEEP INSECTICIDES CONTAINING ALDRIN, CHLORDANE, OR TOXAPHENE OFF THE SKIN AND AWAY FROM THE EYES AND NOSE. AVOID BREATHING VAPOR FUMES OR SPRAY MIST. BATHE THOROUGHLY AND CHANGE TO CLEAN CLOTHING DAILY AFTER SPRAYING OR DUSTING. IF SPRAY MATERIALS ARE SPILLED ON SKIN OR CLOTHING, BATHE IMMEDIATELY WITH SOAP AND WARM WATER.

If the insecticide is accidentally swallowed, induce vomiting by taking 1 tablespoonful of salt in a glass of warm water. Repeat if necessary. Call a doctor.

DO NOT FEED FORAGE CONTAMINATED WITH ALDRIN, CHLORDANE, OR TOXAPHENE TO DAIRY ANIMALS OR TO ANIMALS BEING FINISHED FOR SLAUGHTER.

These insecticides are known to accumulate in the fatty tissues and to be secreted in the milk of animals fed on forage containing the residues. Forage treated with them at dosages heavier than needed for grasshopper control has been fed to meat animals continuously for several weeks to the exclusion of all other feed, without visible impairment of their health or development. However, animals fed for long periods on treated forage may

accumulate enough of these chemicals in their tissues to make the meat unfit for food. This possibility is greatly reduced if no treated vegetation is fed during the last 2 months before slaughter.

If these chemicals are used on fruits and vegetables, DO NOT APPLY THEM TO THE PARTS OF THE PLANTS THAT WILL BE EATEN OR MARKETED unless the residues can and will be removed by washing or stripping.

Bees are essential to legume seed production. BECAUSE OF THE DANGER OF KILLING BEES, DO NOT APPLY THESE INSECTICIDES TO LEGUMES WHILE IN BLOOM. If grasshoppers must be controlled during this period to save the seed crop, spray in the early morning or late evening while bees are inactive. Sprays are less harmful than dusts.

Baits

Wet Baits.--Aldrin, chlordane, or toxaphene in the form of emulsifiable concentrates or wettable powders can be substituted for sodium fluosilicate in any wet-bait formula containing bran and sawdust. Either one kills more quickly and for a longer period than sodium fluosilicate. Aldrin at 2 ounces, chlordane at 1/2 pound, and toxaphene at 1 pound have consistently given at least as good kill as 6 pounds of sodium fluosilicate per 100 pounds of dry bran and sawdust.

Stir the emulsifiable concentrate or wettable powder into the quantity of water required for wet baits and apply to the bran-sawdust mixture in a single mixing operation. They are obtainable at various strengths, but, whatever their strength, use enough to provide the amount of insecticide indicated in the following formula:

Mill-run bran	25 lb.
Sawdust, three times the volume of bran ..	3 1/2 bu.
Aldrin	2 oz.
or	
Chlordane	1/2 lb.
or	
Toxaphene	1 lb.
or	
Sodium fluosilicate ...	6 lb.
Water to make a moist crumbly mash	10-12 gal.

Spread wet bait uniformly by hand or with broadcasting machines at the rate of 20 pounds per acre.

Dry Baits.--For application by airplane dry baits made by impregnating coarse bran with an oil solution of aldrin, chlordane, or toxaphene are preferred over wet baits.

Use 2 ounces of aldrin, 1/2 pound of chlordane, or 1 pound of toxaphene in each 1/2 gallon of solution. Kerosene and fuel oil have been used as solvents. Apply the oil solution as a finely divided spray at the rate of 1/2 gallon to 100 pounds of coarse, dry bran containing no flourlike material.

Power bait-mixing machines may be equipped with spraying devices for this purpose. In mixing dry bait every effort should be made to obtain uniform distribution of the small quantity of solution throughout the dry bran.

The dosage recommended, 5 to 10 pounds of dry bait per acre, is equivalent to 20 to 40 pounds of wet bait in terms of bran content. This small quantity can be uniformly applied by airplane and single-outlet dusters but not by broadcasters designed for handling wet bait. Dry bait may be prepared in advance and stored until needed.

Precautions. -- Baits containing aldrin, chlordane, or toxaphene are very toxic if eaten by livestock. When baits are spread uniformly at recommended dosages, the animals cannot pick up enough flakes to affect their health, but if they have access to baits stored in sacks or piles or to heavy accumulations on the ground, their health and lives are endangered.

STORE BAIT WHERE LIVESTOCK CANNOT REACH IT AND AVOID GROUND ACCUMULATIONS.

KEEP LIVESTOCK OFF AIR STRIPS WHERE PLANES ARE BEING LOADED.

LOAD PLANES WITH AS LITTLE SPILLING OF BAIT AS POSSIBLE, AND CLEAN UP ALL SPILLED BAIT ON THE AIR STRIPS OR IN SURROUNDING GRASS, WEEDS, OR BRUSH.

Community Action Needed for Successful Control

Regardless of the method used, grasshopper control is most effective when all property owners in a community cooperate in destroying threatening infestations of grasshoppers wherever they are found.